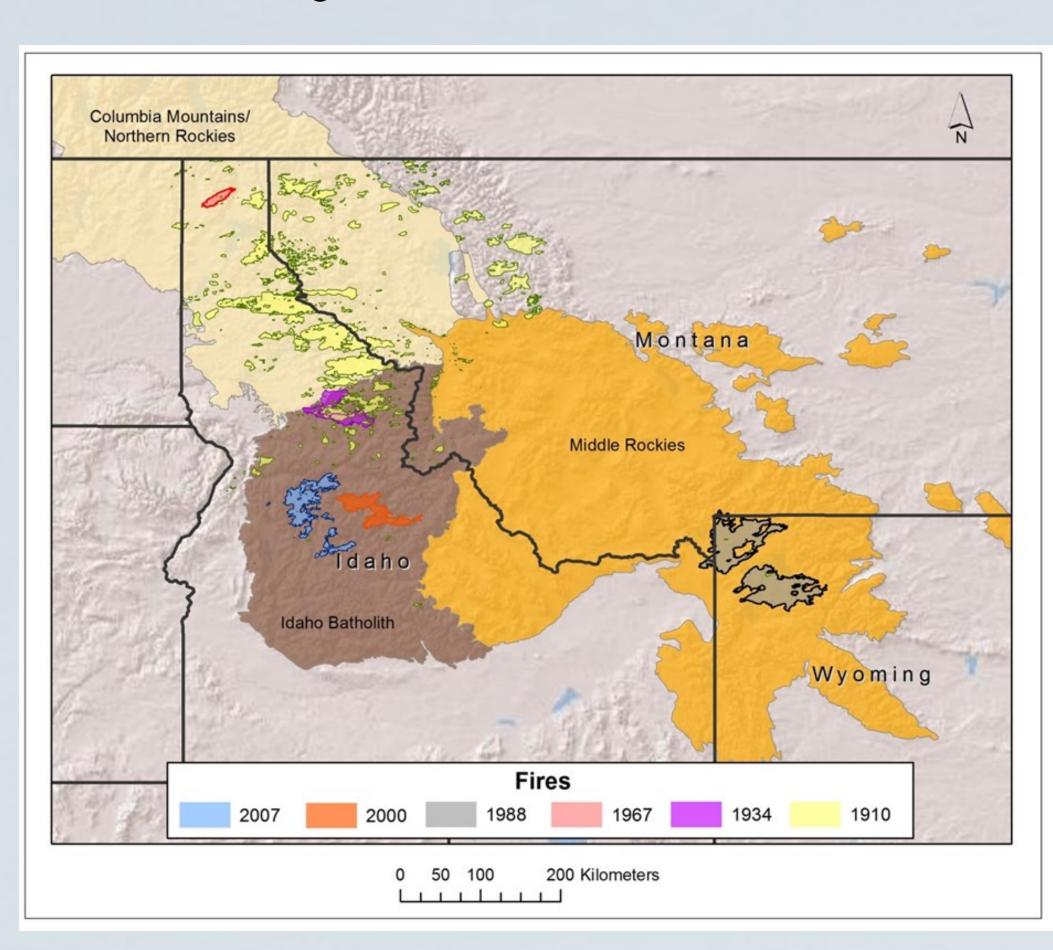
Development of an Extreme Wildland Fire Recovery Chronosequence

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INTRODUCTION

In order to predict ecological recovery from extreme wildland fire events under future climate scenarios, datasets are needed to cover the temporal range over which climate effects are observed (i.e. 50-100 years). We explore the utility of developing an Extreme Wildland Fire Recovery Chronosequences for the Northern Rockies and the Northern Great Basin. This is accomplished by evaluating representative forest and rangeland ecosystems in which historically extreme wildland fire events occurred from 1910-2007. The fires selected represent outliers of normal wildland fires, either because of their extreme size, severity, or fire behavior. The fires selected for analysis included fires from 1910, 1934, 1967, 1988, 2000, and 2007. Using a combination of historical regional fire atlas data, World Fire Atlas data, Monitoring Trends in Burn Severity



(MTBS) fire perimeter data, and Landsat satellite imagery. Post-fire vegetation indices are calculated using archival imagery dating back to 1984.

Each fire provides a snapshot in time of post-fire recovery (75-100, 50-75, 17-32, 0-25, 0-12, and 0-5 years post-fire), and are combined to build a fire recovery chronosequence. Remotely sensed recovery rates for rangeland fires were also explored to evaluate differences in biomes and to quantify the effect of image seasonality.

METHODS

To limit the signal to noise variability between fires, a series of environmental, disturbance, and management factors were controlled in identify candidate fires. This initial assessment of fire criteria was conducted using ArcGIS 10. The criteria used included:

- Fires were selected to be roughly 25 years apart.
- Only fires within the Northwestern Forested Mountains Level 1 ecoregion were selected to limit the recovery data to a consistent biome (CEC, 2009).
- Fires were limited to the woodland and forested ecosystems
- Fires where no re-burn had occurred were selected from the regional fire atlas.
- Fires were limited to protected lands where no management had occurred.
- To further limit the differences in fires effect on vegetation mortality we only analyzed pixels classified as high severity by the MTBS burn severity product.

The fires selected are listed below, as well as, the years post fire that images were available, and the dominant vegetation type.

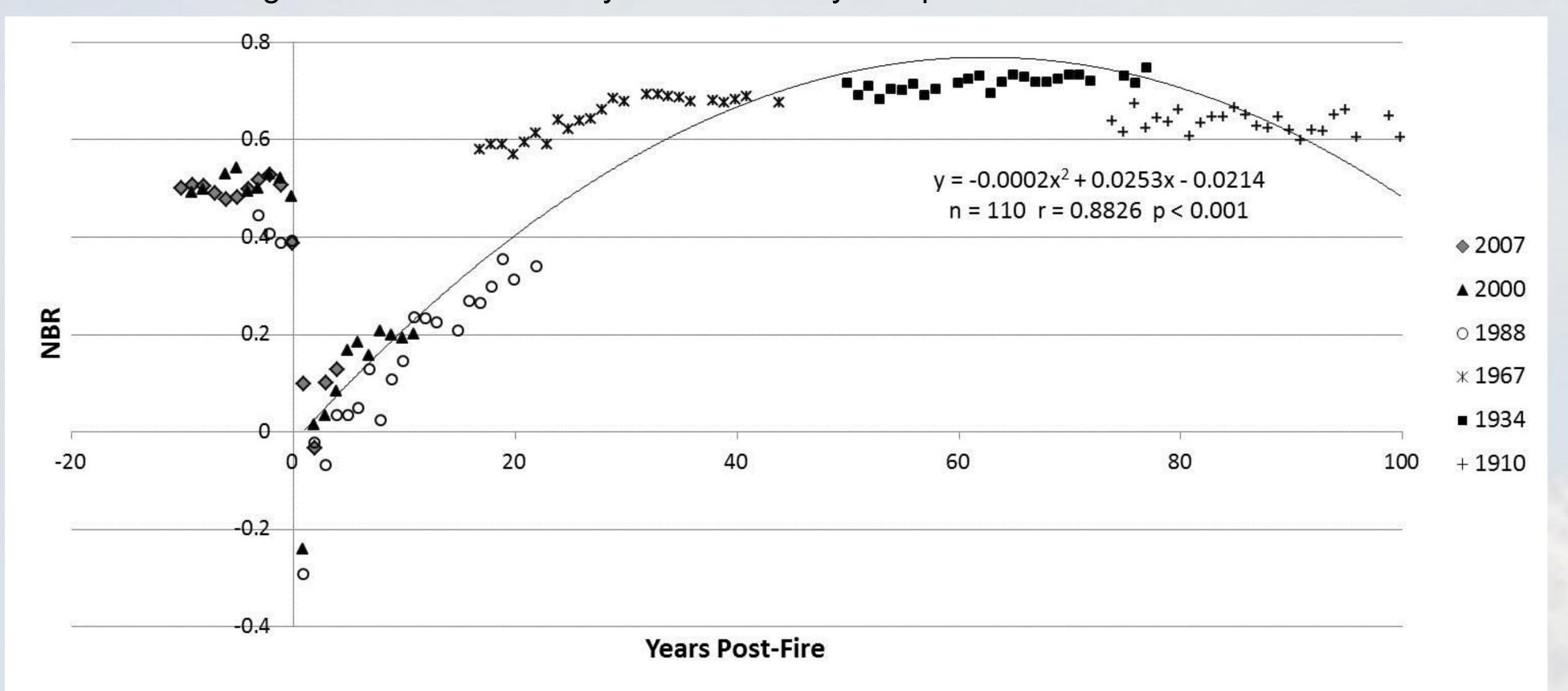
	and the	dominant vegetation		
	Year	Post-Fire Image Availability	Dominant Vegetation	Fire Name
	1910	74-101 years	Predominantly conifer-dominated forest and woodland	"The Big Burn"
	1934	50-77 years	Predominantly conifer-dominated forest and woodland	"Selway Fire"
	1967	17-44 years	Predominantly conifer-dominated forest and woodland	"Sundance Fire"
	1988	(-4)-22 years	Predominantly steppe, montane grass- land, and conifer-dominated forest	"North Fork Fire"
	2000	(-10)-11 years	Predominantly conifer-dominated forest and woodland	"Diamond Complex"
	2007	(-10)-4 years	Predominantly conifer-dominated forest and woodland	"East Zone Complex"

Normalized Burn Ratio (NBR)

- NBR = (Band 4—Band 7)/(Band 4 + Band 7)
- Normalized Difference Vegetation Indice (NDVI)
- NDVI = (Band 4—Band 3)/(Band 4 + Band 3)

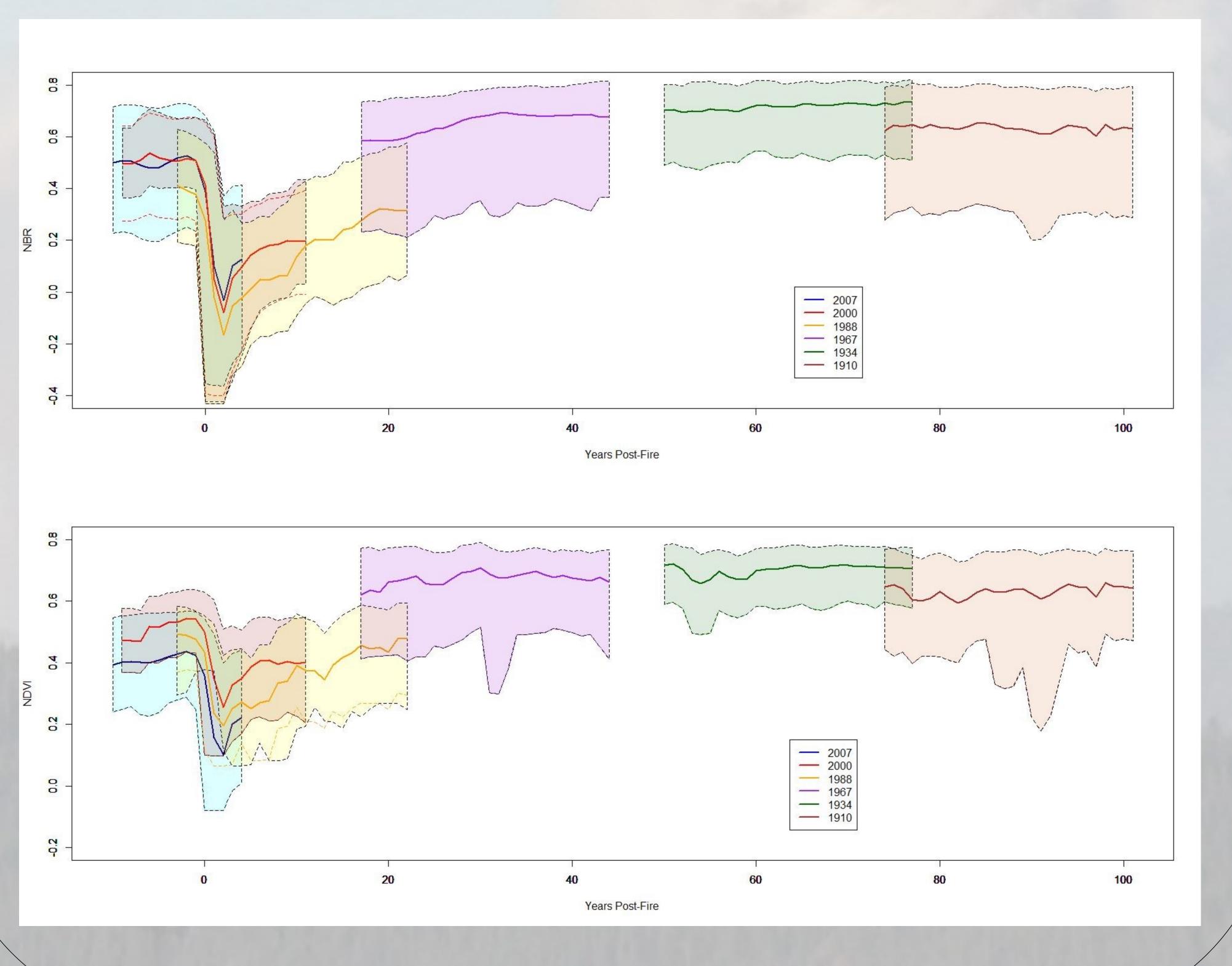
RESULTS

The results of this research show that using similar fires spaced out in 25 year intervals we can build a chronosequence for high severity sites. In this first graph we used NBR anniversary Landsat 5 images to create a recovery curve for 100 years post fire.



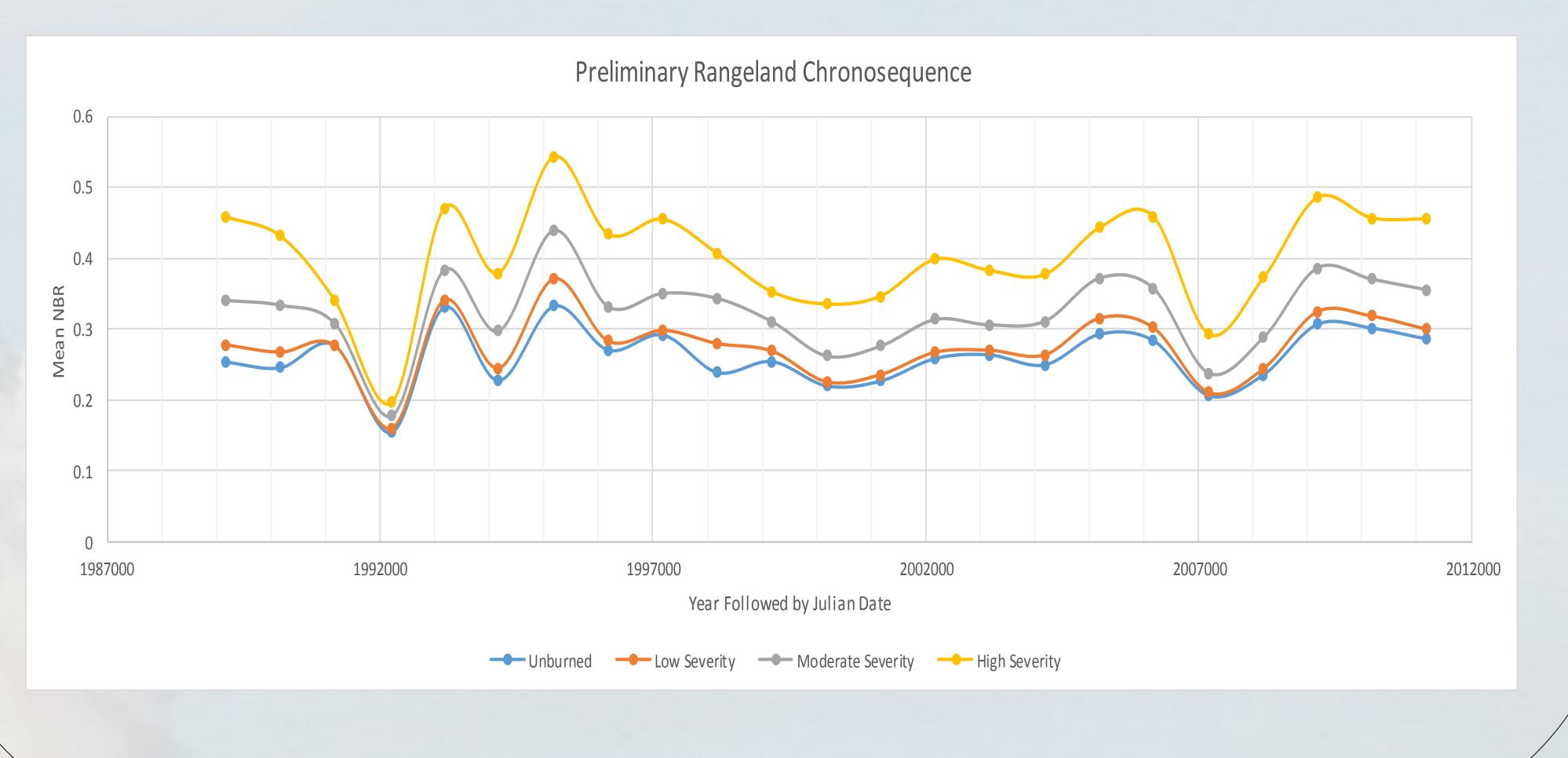
To better understand the variability from year to year and between NBR and NDVI we created a graph with the mean, 5th percentile, and 95th percentile. To further remove noise a three year moving average was used to smooth the data. The analysis highlights:

- A clear signal showing potential of trading space for time in understanding extended vegetation recovery.
- NBR shows lower variation between fires than NDVI.
- The improved signal provided by NBR is attributed to limiting the analysis to areas identified as burning at high severity by MTBS using dNBR.



PRELIMINARY RANGELAND CHRONOSEQUENCE

Preliminary work on developing a chronosequence for rangeland fires has shown that the date of the anniversary image chosen is much more important in a rangeland setting due to the seasonal variability in vegetation greenness. With the growing season for Southern Idaho Rangelands occurring between April and July, the graph below highlights the temporal dependence of NBR calculations for the Thorn Creek fire of 1990. The 1992 image was 33 days off of the anniversary date chosen; this deviation in anniversary date is obvious in the graph below. We stratified the NBR analyses across four burn severity levels. As can be seen by the NBR values produced by the 1992 image, there is a convergence of NBR values across burn severity once the system senescence's. This seasonality dependence becomes more apparent when using NDVI. The seasonality of the rangeland environment will require more advanced processing than our forested chronosequence. Further research will be focusing on how to account for the seasonality of rangeland vegetation from the chronosequence.



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